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Architecting the Digital Universe



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Thursday – Infrastructure

Gadi Singer
Enterprise – The Road Ahead
Sean Maloney
The Communications Industry After the Slump



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Enterprise Technologies - Innovations and Directions

Gadi Singer
GM Enterprise Processor Division
VP Intel Architecture Group
30th August, 2001



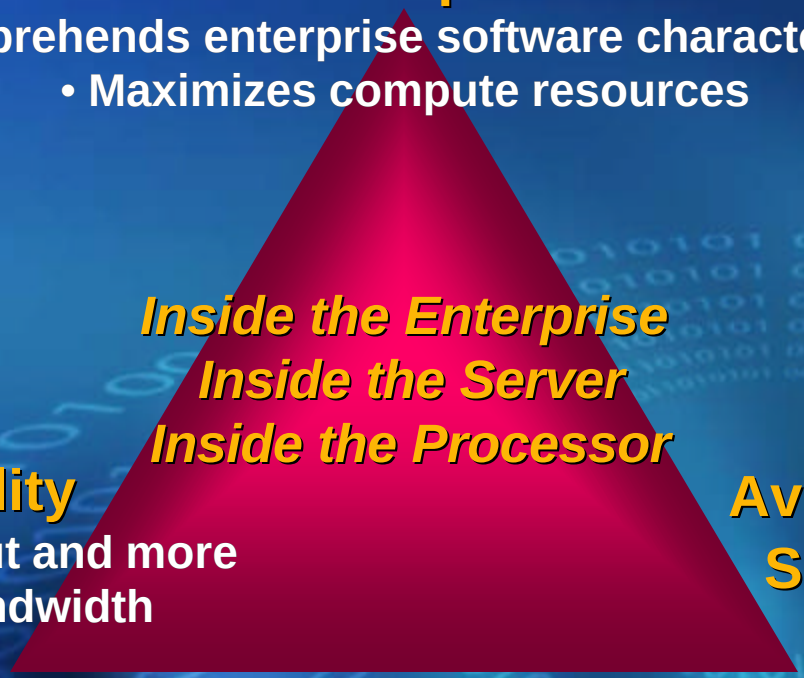



Accelerating Enterprise Technologies
Through Innovations
and Enabling Standards
Focus: Getting the most out of each clock cycle
intel inside
ITANIUM
intel inside
pentium III xeon
intel inside
XEON
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Enterprise Technology Requirements

Efficient Compute Power

- Comprehends enterprise software characteristics
- Maximizes compute resources



Scalability

- Scale up and out and more
- Massive bandwidth

Reliability, Availability, and Serviceability (RAS)

- End-to-end uptime

Intel: Enabling technologies, standards and building blocks to accelerate innovation for enterprise

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Getting the Most Out of Each Clock Cycle

Maximum Utilization ("min

Efficient Compute Power

- Abundance of Parallel Resources



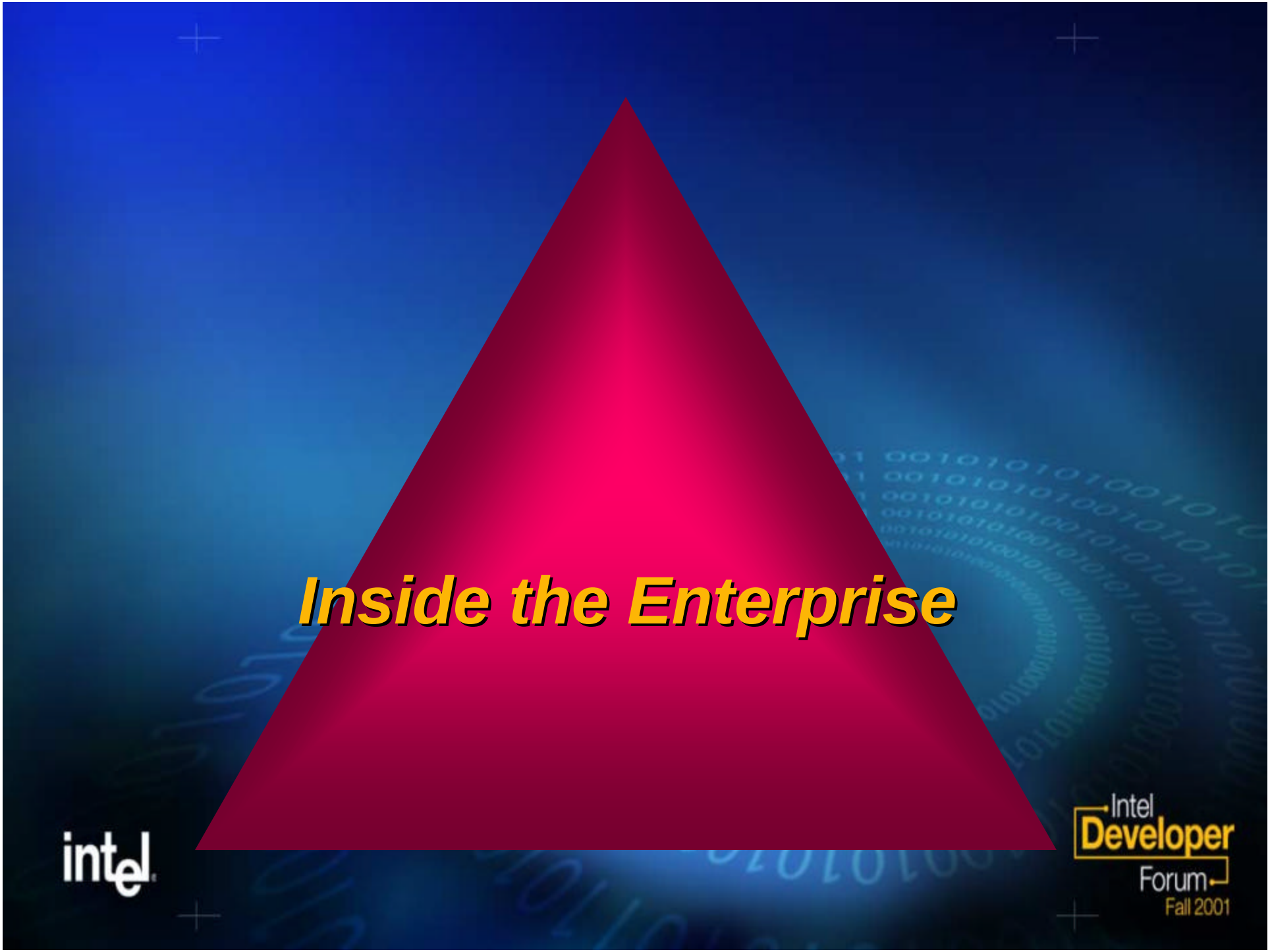
- High Bandwidth Interconnect

Scalability and RAS

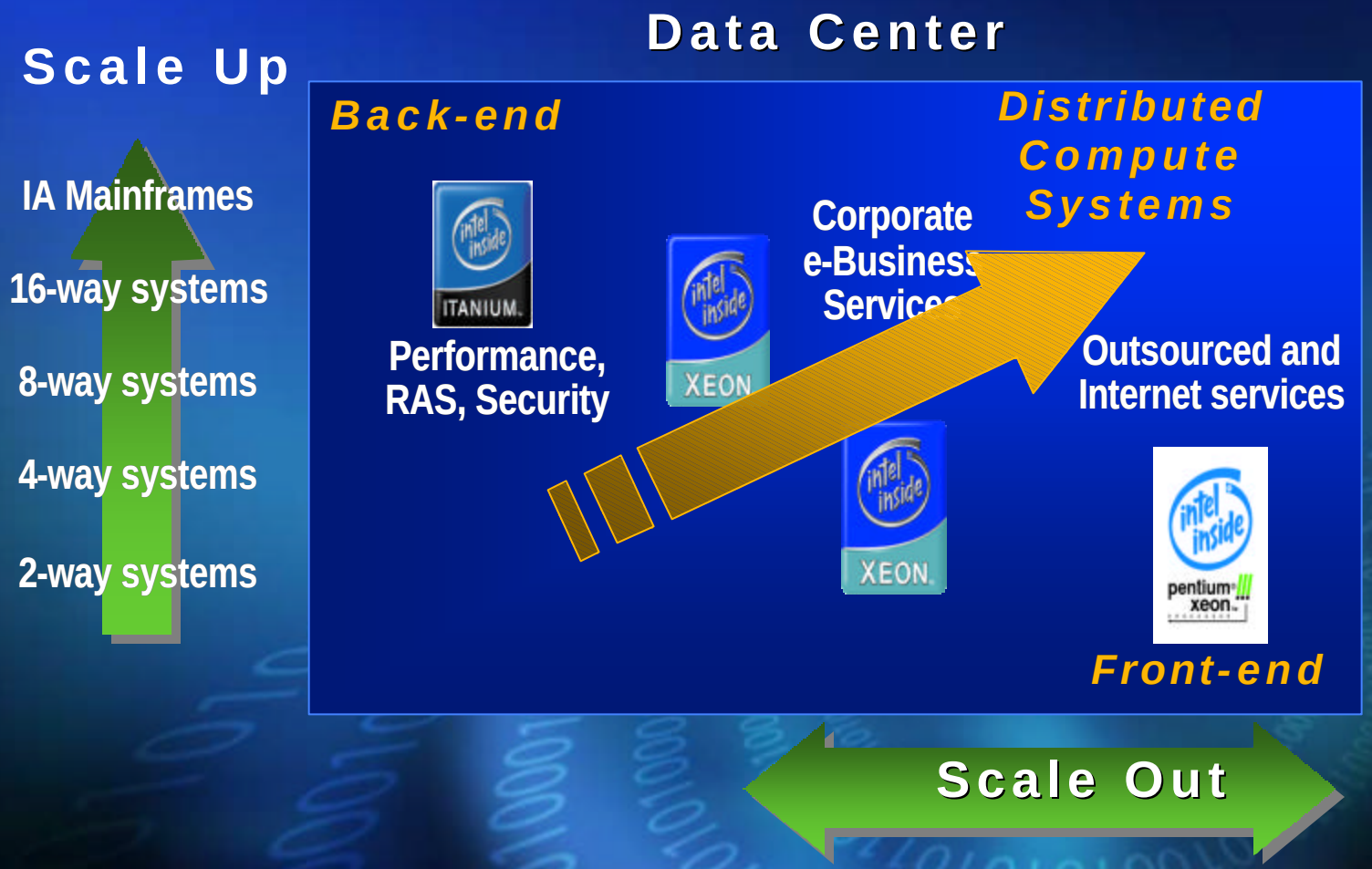
- Easily and Reliably expand Resources, Concurrency and Connectivity

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Inside the Enterprise
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Scalability...*and More*

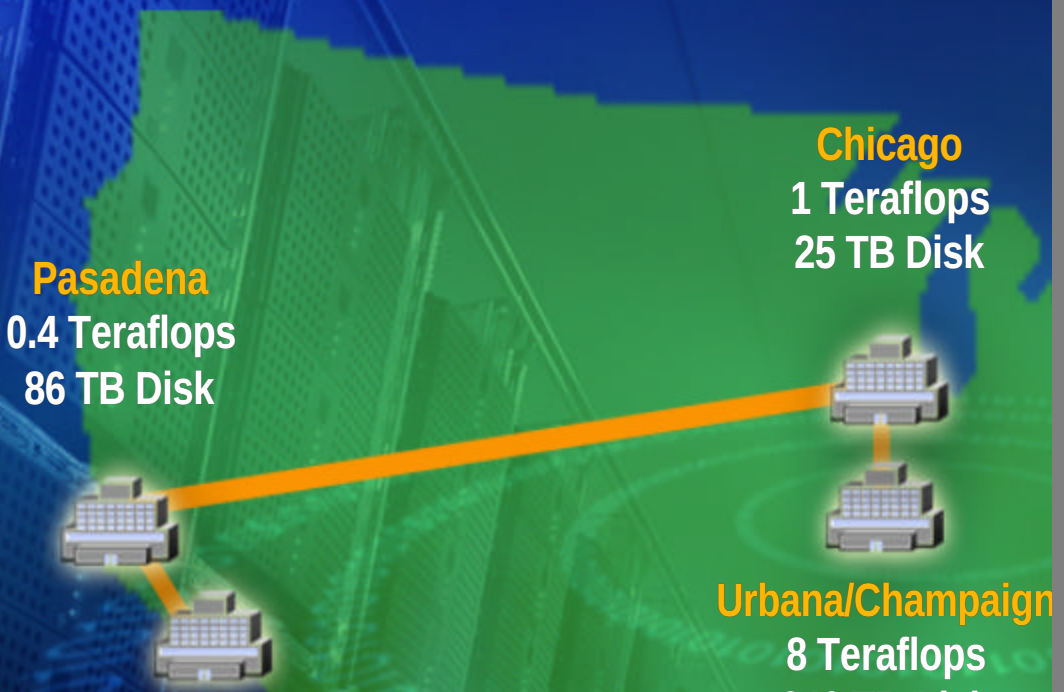


Disaggregated Cost-Effective Compute and Storage Blocks Connected by High Bandwidth Interconnect

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Distributed Compute System

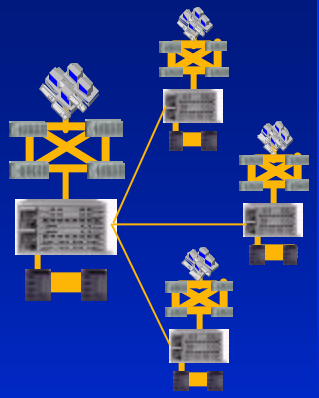
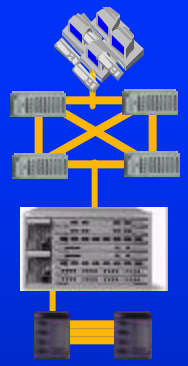
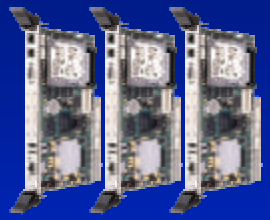
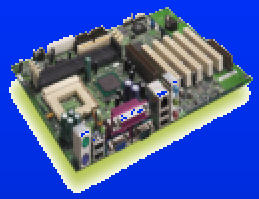
TeraGrid Example



- 3300 *Itanium™* and *McKinley* processors connected via dedicated interconnect, 4 sites
- *13.6 trillion calculations/sec* and the ability to work with *450 trillion bytes* of data

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Comprehensive Interconnects

Inter-Facility	Inter-System	Intra-System	Intra-Board
			
Site to Site Data Center to Data Center	Box to Box	Blade to Blade Line Cards	Chip to Chip/ Add in Card

Ethernet

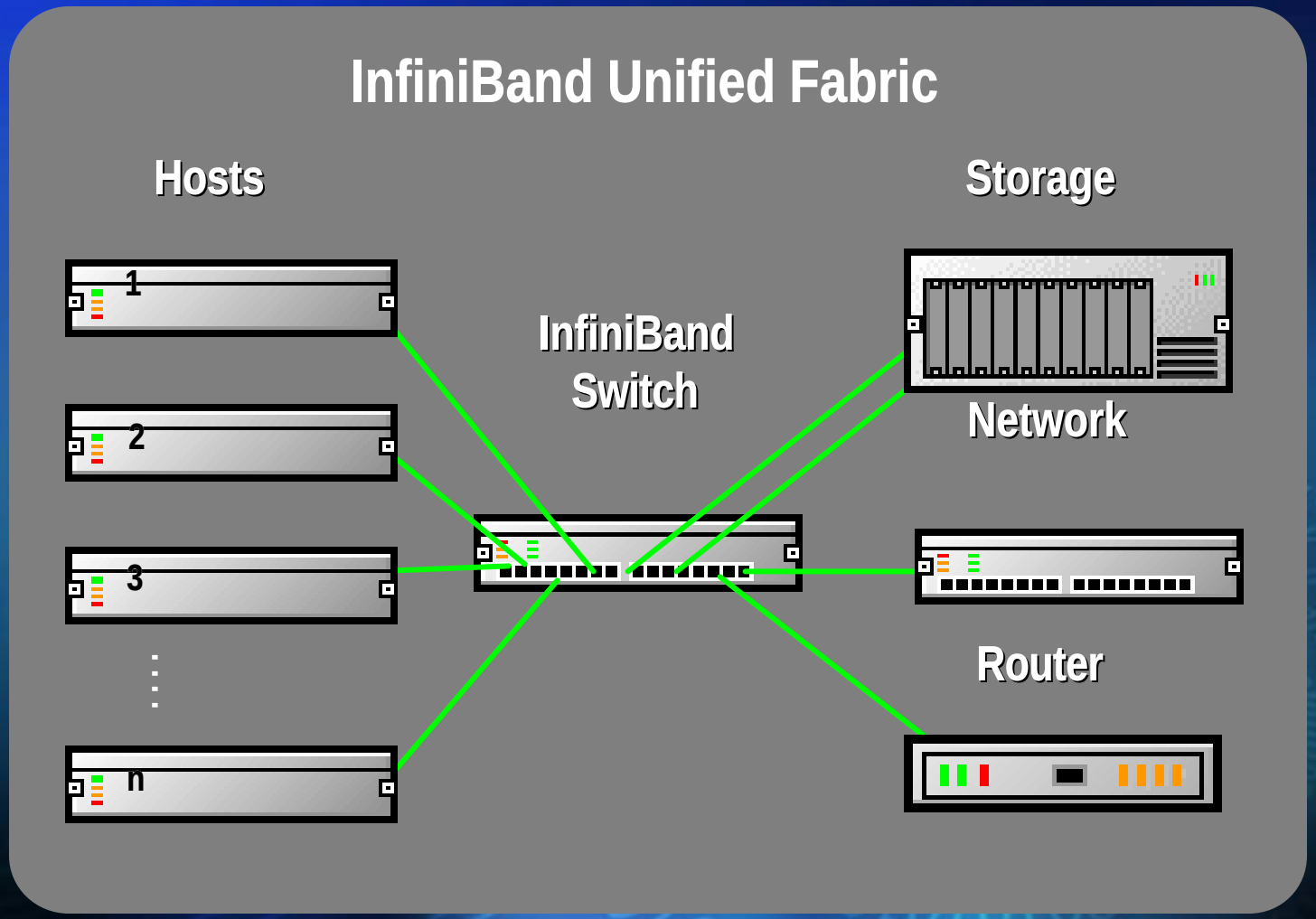
InfiniBand

3GIO

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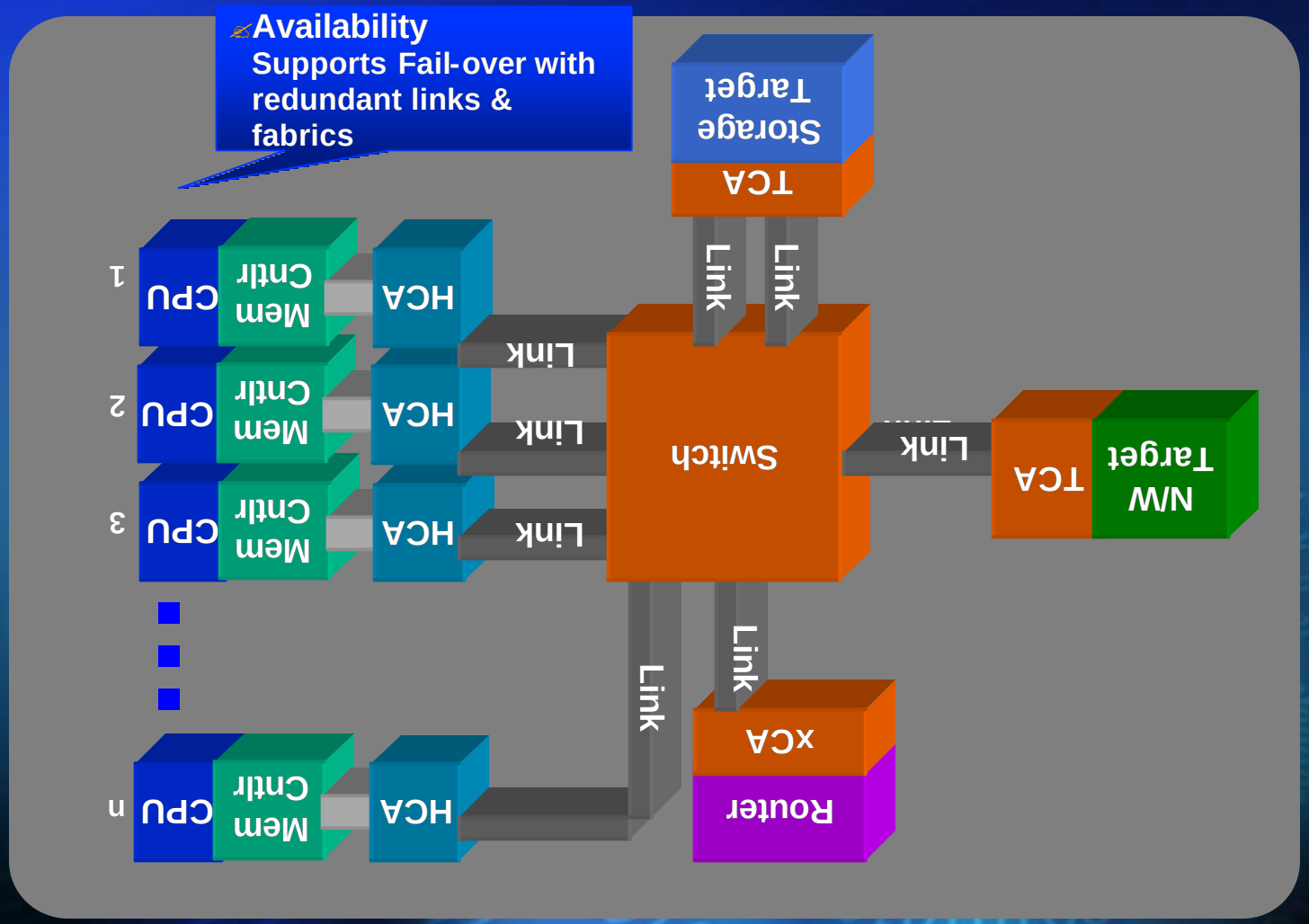
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InfiniBand* HW Architecture



*Other brands and names are the property of their respective owners

InfiniBand* HW Architecture

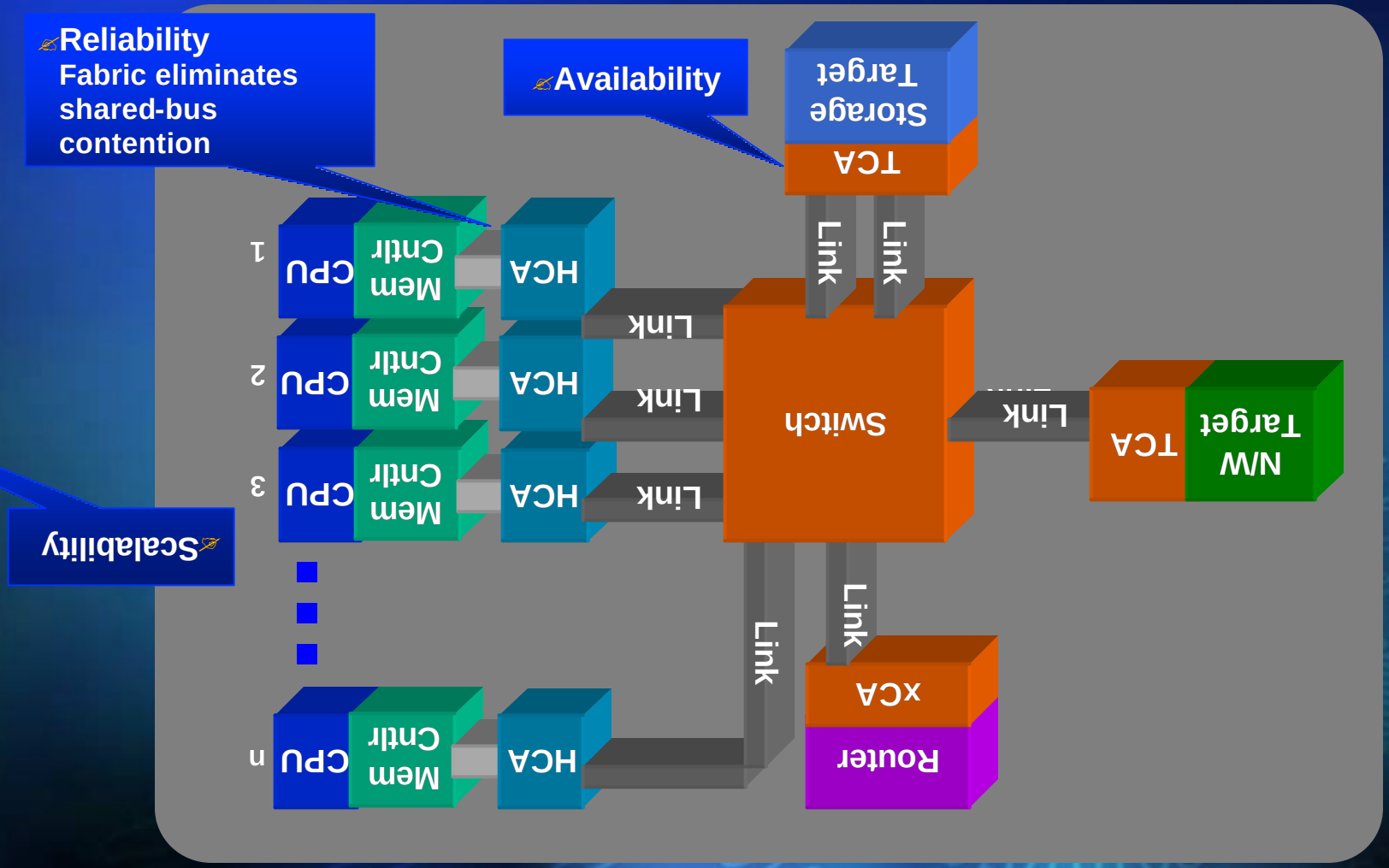


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InfiniBand* HW Architecture

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InfiniBand* HW Architecture

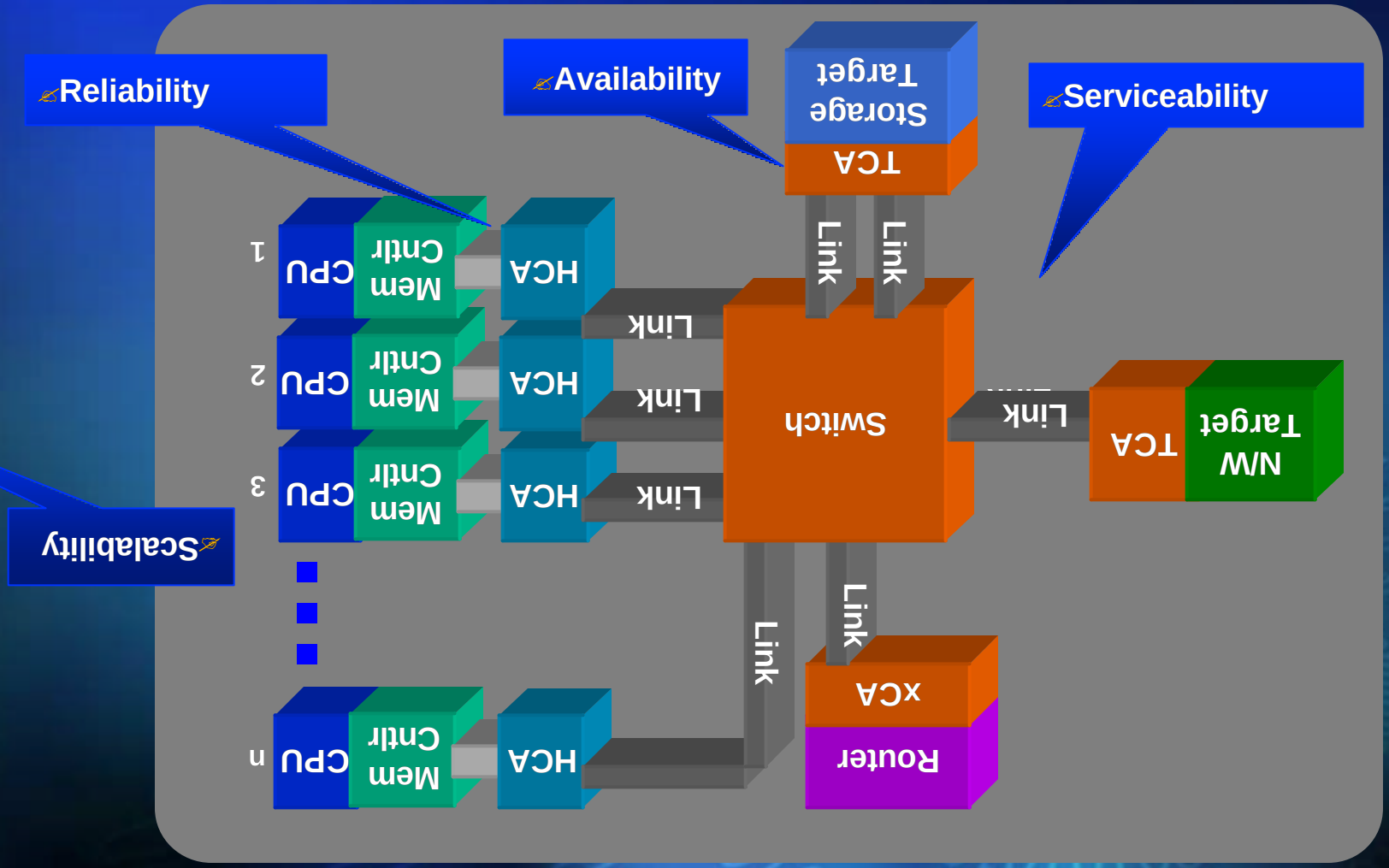


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InfiniBand* HW Architecture

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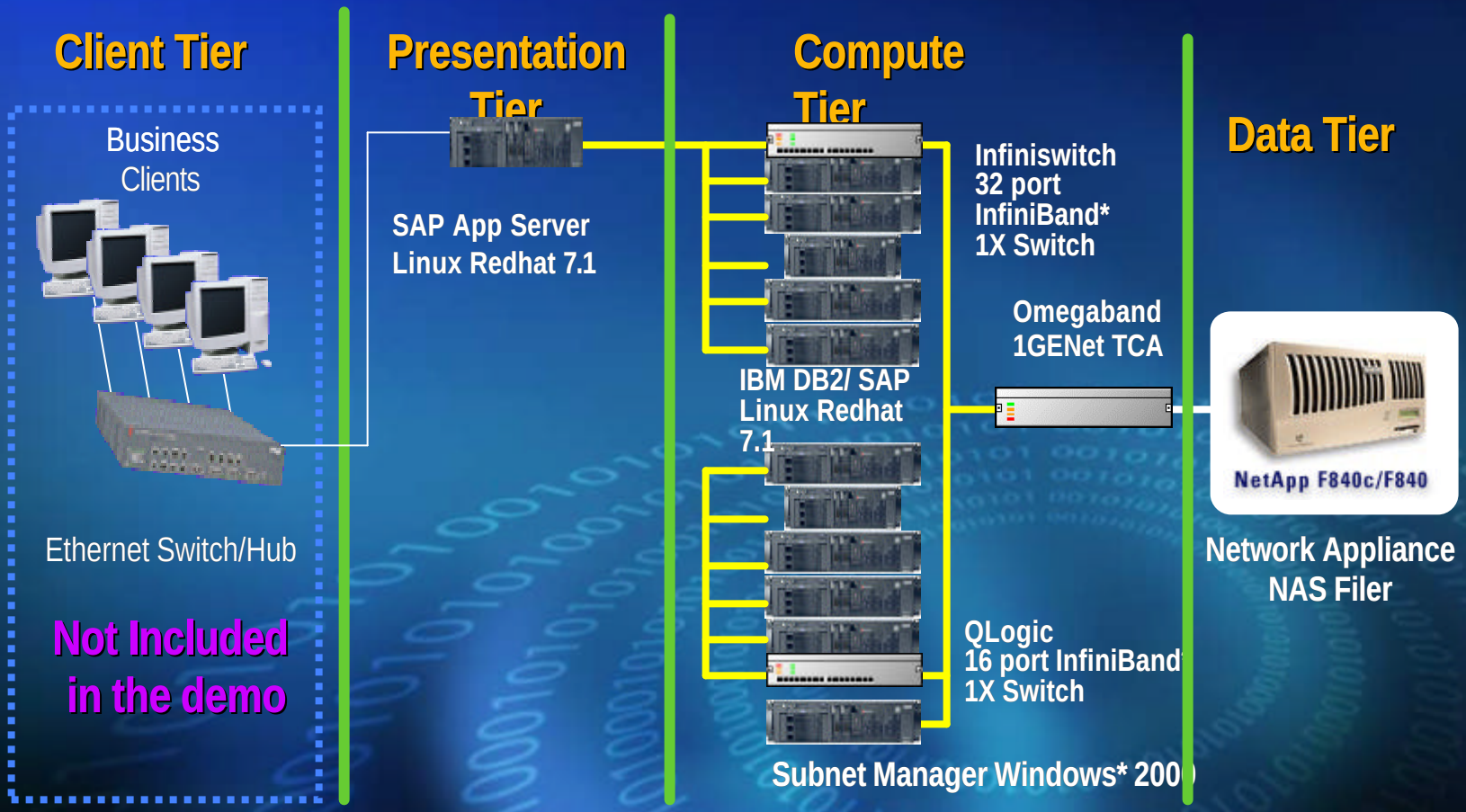
InfiniBand* HW Architecture



Unified fabric for IPC, Networking, and Storage in a Data Center

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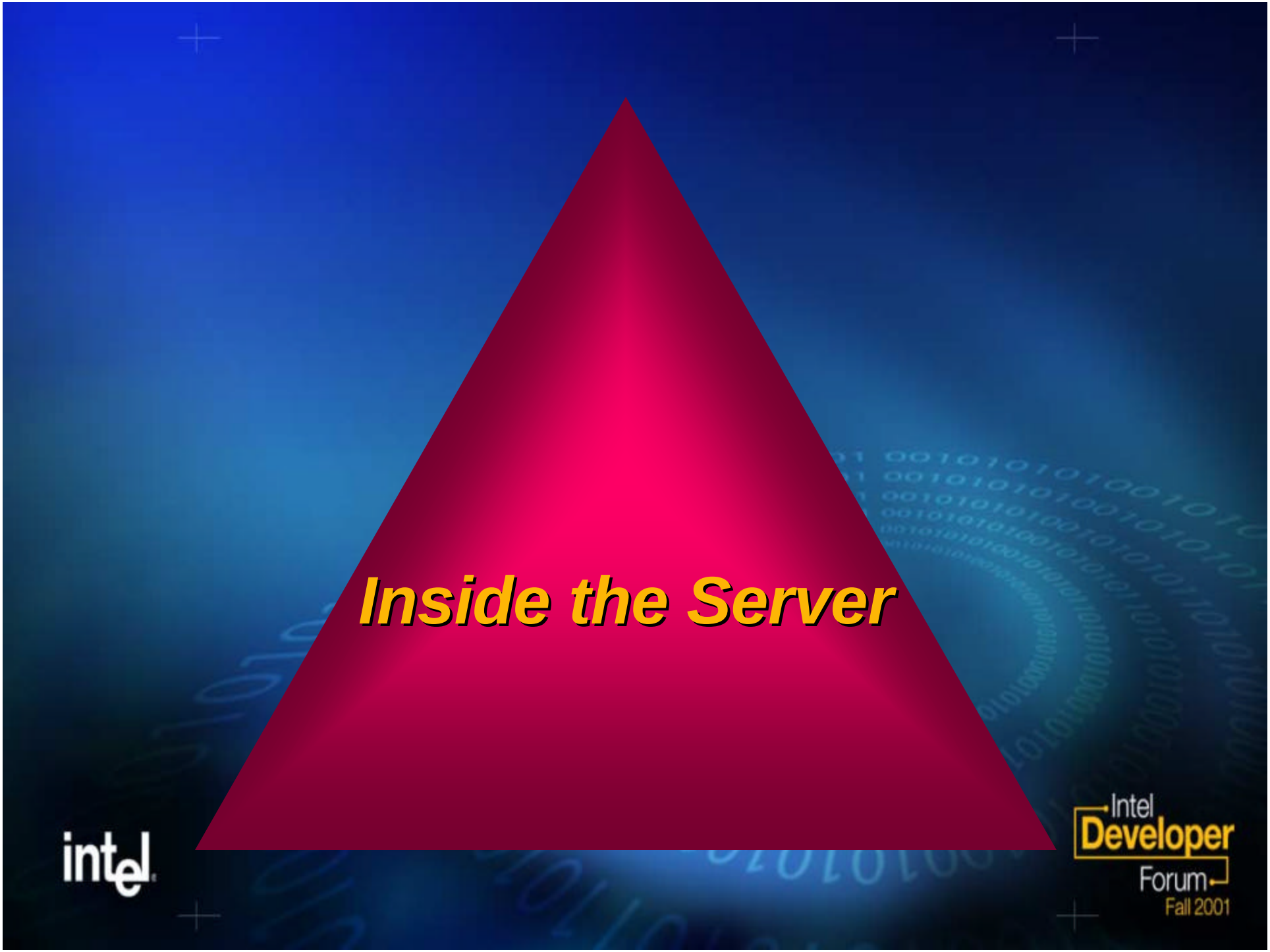
Intel-IBM InfiniBand* Demonstration Configuration



Twelve IBM X-Series Model 342 w/ Dual Pentium® III processors
and Intel InfiniBand* Host Channel Adapters

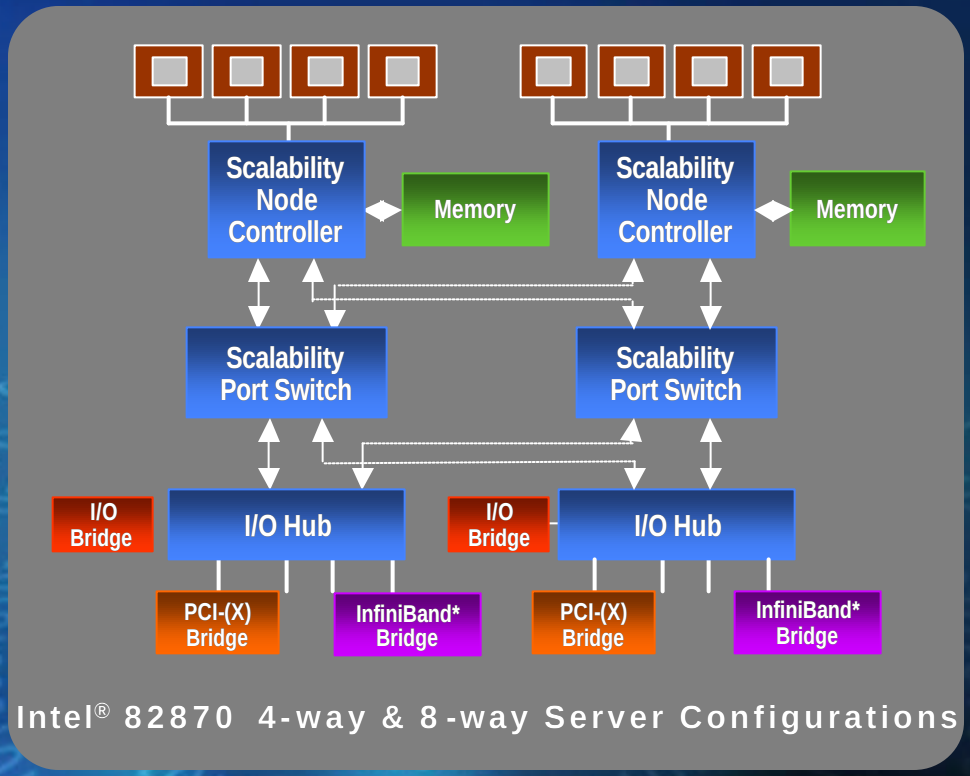
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Inside the Server
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Scalability and RAS Built-in to Next Generation Server Designs

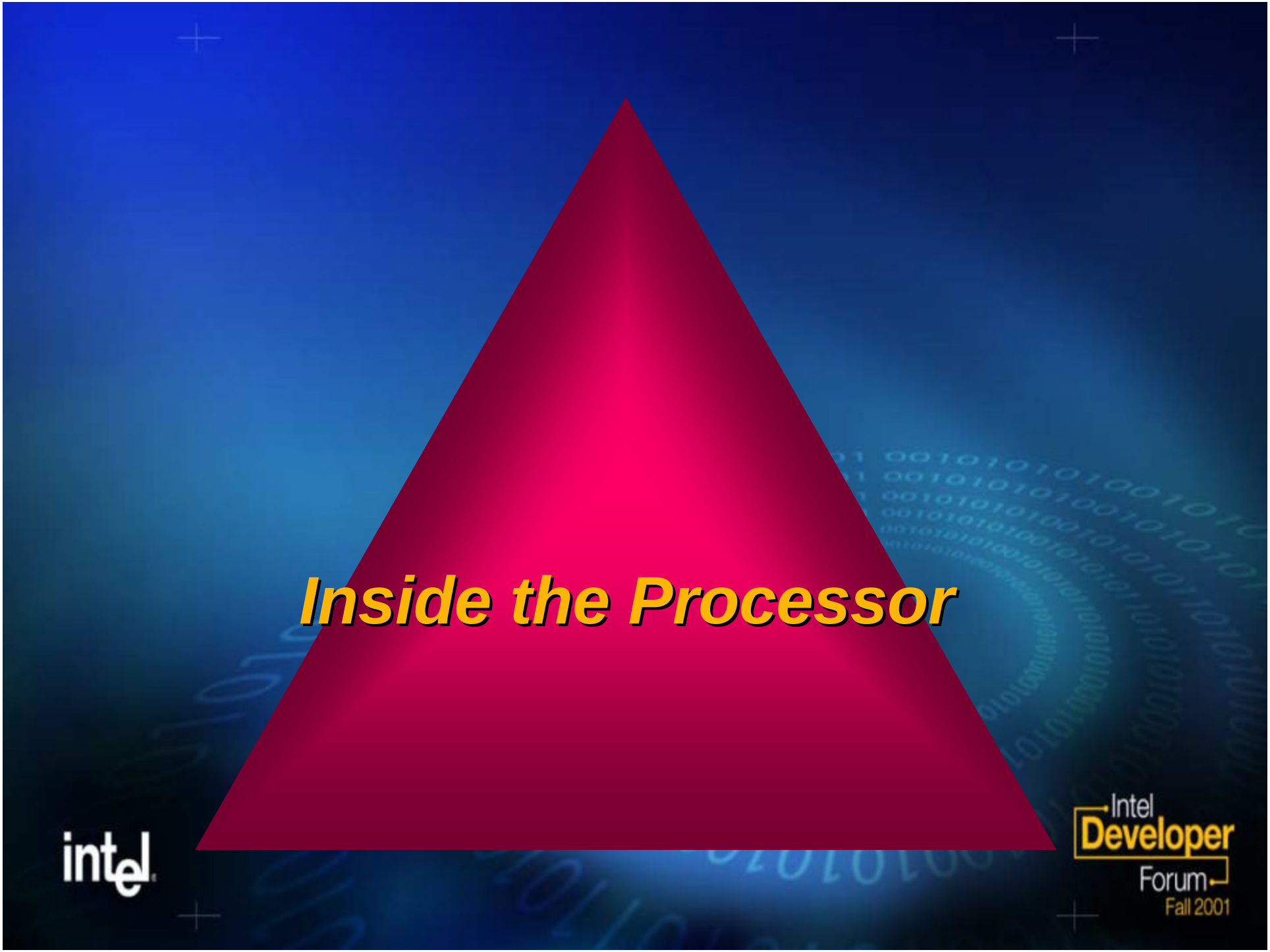
- Highly Scalable Architecture
 - 2 - N way systems
- RAS
 - Extensive error detection, correction and containment
 - Hot-plug on Scalability Port
- Balanced System Performance
 - Scalability Port, Memory, & I/O bandwidths support high system throughput



Intel® 82870 4-way & 8-way Server Configurations

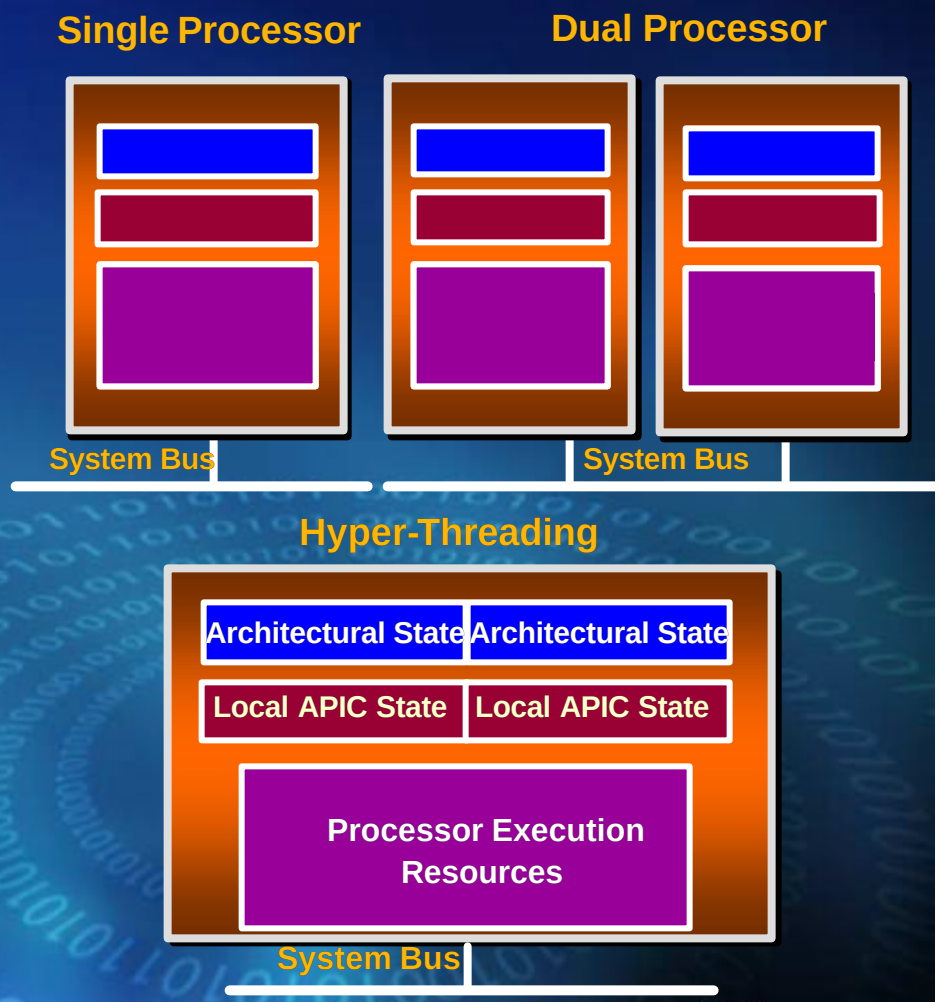
Easily and Reliably expand Resources, Concurrency and Connectivity

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Inside the Processor
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Hyper-Threading Technology

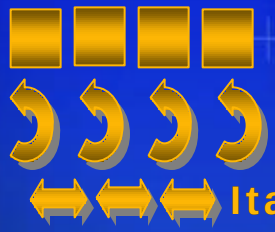
- Exploits thread-level parallelism in software to increase use of on-chip execution resources
 - Provides up to 30% performance gain
- Increases instruction processing throughput when executing multi-threaded code
- Existing MP aware software is compatible with Hyper-Threading enabled platforms
 - No need for code recompilation



Hyper-Threading technology will first appear in Intel CPUs in '02

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McKinley Enhancements



Itanium™ Processor

2.1 GB/s
64 bits wide
266 MT/s

4 MB L3 on-board cache, 96K L2

Pipeline Stages

10

1 2 3 4 5 6 7 8 9

Issue Ports

328 on-board Registers

4 Integer, 3 Branch

2 FP, 2 SIMD

2 Load or 2 Store

800 MHz

6 Instructions / Cycle

EPIC Architecture

6.4 GB/s
400 MT/s
128 bits wide

On-die L2 Processor

On-die cache, 256K L2

3MB L3 on-board cache

Pipeline Stages

1 2 3 4 5 6 7 8 9 10 11

Integer, Branch

SIMD

Load & Store

1 GHz

Instruction

Higher bus bandwidth

On die L3 cache, improved cache latency

More issue ports, more parallelism

More execution units

Increased frequency

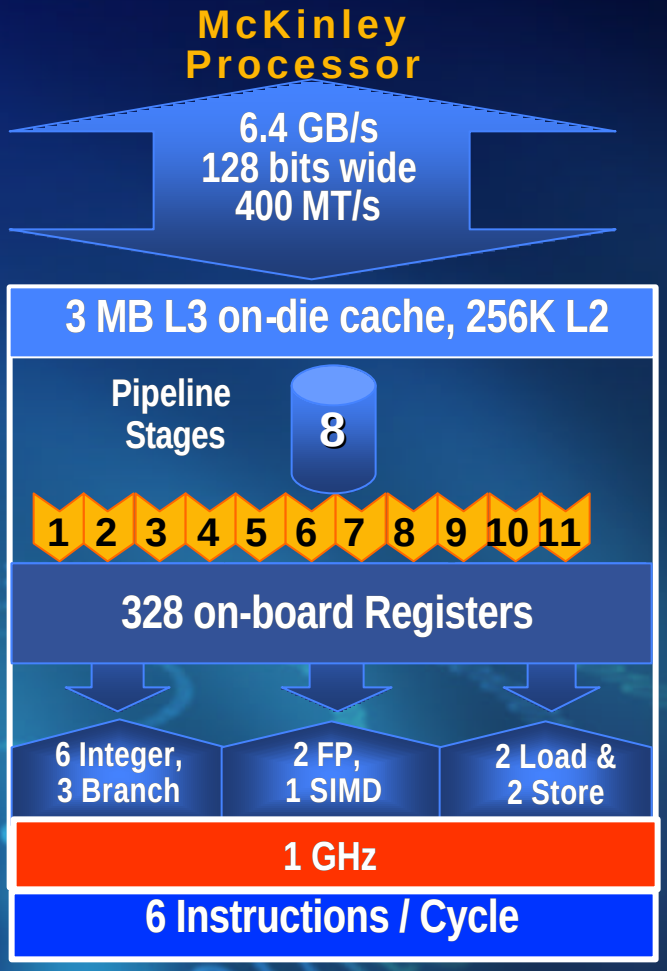
Enhancements build on Itanium™ architecture foundation

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McKinley Features

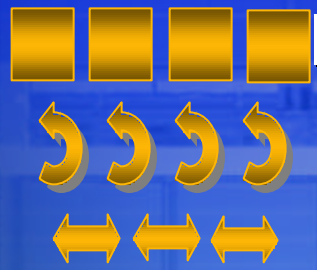
- McKinley Builds on Itanium™ processor's EPIC design
 - McKinley is binary compatible with Itanium
- Provides performance scaling
 - McKinley provides 1.5x – 2x performance scaling over Itanium™ Processor
 - Example: specint2000 benchmark expected to run ~ 70% faster on McKinley without recompilation



EPIC Architecture

McKinley provides significant performance scaling on existing Itanium™ processor binaries. Develop for the Itanium processor today

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Itanium™ Processor Family Futures

Sneak Peak

- Madison Processor
 - Shares same chip set, system bus and processor form factor as McKinley
 - 0.13 micron process
 - Up to 6MB on-die L3 cache
 - Targeting platform release in 2003

- Future Technologies
 - Multi-threading
 - Multi-core / multi-die technologies

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Itanium™ Processor Update (Since Spring IDF)

Itanium Processor Platform Release

Spring IDF

HP-Intel McKinley Demo

System Announcements

DELL, hp, COMPAQ, HITACHI, sgi, IBM, MITSUBISHI, NEC, FUJITSU, Bull, FUJITSU SIEMENS, UNISYS

OS Announcements

HP-UX 11i, Windows Advanced Server Limited Edition, Windows XP, SuSE, CALDERA, redhat

May 29 — Q3 — Fall IDF

NCSA TeraGrid

- 3300+ Itanium family processors
- 13.6 TFlops

Intel–BEA Agreement

- Jointly optimize BEA* WebLogic* software
- Joint sales & marketing programs

Compaq-Intel Agreement

–Porting *Tru64 UNIX*™, *OpenVMS*™ and *NonStop*™ Kernel

–Alignment, over time, of ALL Compaq 64-bit enterprise servers on the Itanium™ processor family

Windows Advanced Server LE Announcement

Hardware in production, ecosystem build out continues. Widest system and OS support for any 64-bit platform

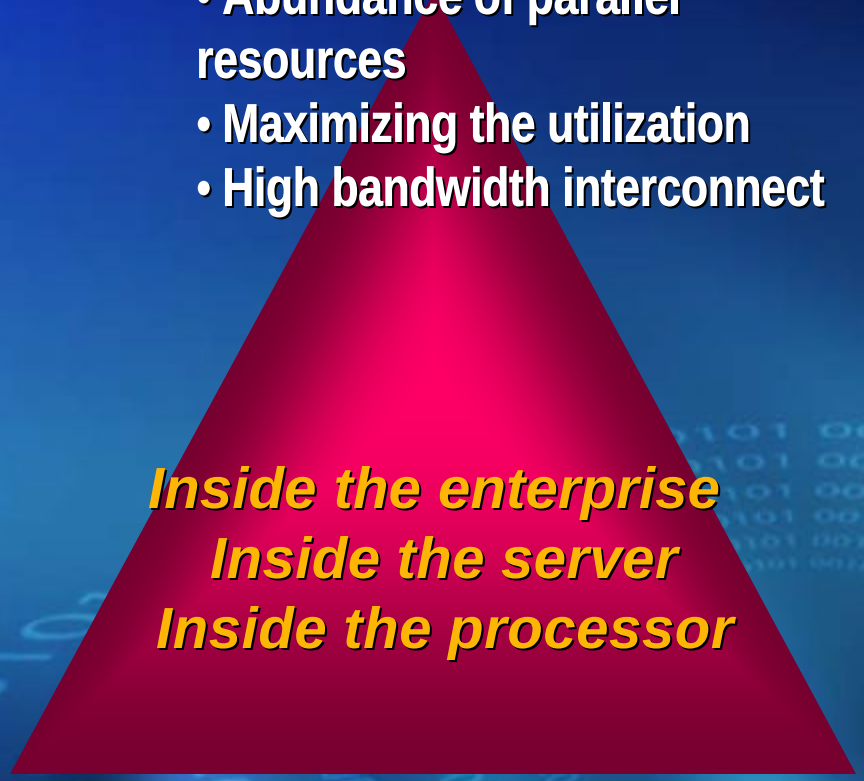
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REUTERS
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ITANIUM
DEMO

Efficient Compute Power

- Abundance of parallel resources
- Maximizing the utilization
- High bandwidth interconnect



Scalability

- Scalability Port
- InfiniBand* Architecture
- 3GIO

RAS

- Processors / chipsets Machine Check Architecture
- InfiniBand* Architecture

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Your Opportunity

- Innovate around increasing parallelism
 - Develop for Hyper-Threading technology on Intel® Xeon™ and future IA-32 processors
- Address the single largest growth opportunity – Win the Enterprise with Itanium™ processor family
 - Servers, workstations and operating systems are in production for the Itanium™ processor
 - Application vendors: Complete Itanium™ processor validation and release production software for Itanium™ processor today


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